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ABSTRACT

This document is one of ten curriculum guides developed by the Nevada Competency-Based Adult High School Diploma (CBAHSD) Project. This curriculum guide on life science is divided into twelve topics. The topics included are Life Process, Cells, Levels of Organization, Organ Systems, Food and Oxygen-Photosynthesis, Cycles, Energy, Resources, Cell Division, Sexual Reproduction, Inheritance, and Predicting Heredity. Competency statements and performance indicators are designed to be used as pre- and post-tests. Answer keys are also provided. This set of curriculum guides is accompanied by both a teacher's guide and a student handbook. (BM)

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CE 024 151

NEVADA COMPETENCY BASED
ADULT HIGH SCHOOL DIPLOMA PROJECT

LIFE SCIENCE

U.S. DEPARTMENT OF HEALTH,
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INTRODUCTION

This package is based on life science (biology) areas. It is set up in three general sub-categories of information with four competency statements for each general sub-category. For each competency there are four performance indicators which can be used by the teacher as indicators of knowledge by the student about the competency. It is strongly suggested that any individual who is rewarded with passing a competency be exposed to and pass at least two of the indicators. For this reason, it is recommended that a minimum of two indicators for each statement be used before a teacher awards credit for completion of a competency. This can be accomplished together or one at a time at the teacher's option. In selecting indicators for the pre-test, it is suggested that the most objective of the indicators be used first.

From the results of our preliminary information and tests with this package, it appears that a minimum passing standard of approximately 90% correct is appropriate. It is strongly suggested, however, that during the grading or shortly thereafter the student be consulted to make sure there were no problems with understanding or interpretation of questions. This tool will be especially useful in making the program individualized and in making the fairest possible decision on the passing or failing of each item. Of course, if in doubt, another test item may be administered.

It is again worthwhile to mention that many of these items are best handled orally. Students frequently will be able to give a better explanation

orally than in writing. The teacher can also get a better indication of student knowledge through probing questioning behavior related to the item or competency.

The pre-test for the competency can be administered one at a time, in a group with the others of the same sub-category or all at once depending on the student. If the student fails the pre-test, they should study the competency until he or she can pass a post-test. The post-test should be made up of the indicators which were not used in the pre-test (as much as possible). The student should be allowed to attempt post-tests as many times as it takes to pass the competency. The program is designed to give the teacher the freedom to construct other test items and use his or her judgment in passing a student based on an adequate demonstration of knowledge.

The answers to the subjective type questions are of course subjective. The answer sheet has been provided to give teachers a basic idea of what is expected and should not be taken as the only possible way of stating the answer. Be sure again to apply these individually and with large amounts of good sound judgment.

TOPICS

CHARACTERISTICS OF LIVING THINGS

Life Process

Cells

Levels of Organization

Organ Systems

INTERACTIONS BETWEEN MAN, LIVING THINGS AND THEIR ENVIRONMENT

Food & Oxygen - Photosynthesis

Cycles

Energy

Resources

REPRODUCTION AND INHERITANCE

Cell Division

Sexual Reproduction

Inheritance

Predicting Heredity

LIFE SCIENCE

Life Processes

LS - 1

Pre-test: #1 and #3
Post-test: #2 and #4

The student will be able to list and explain the life processes which are characteristic of all living things.

PERFORMANCE INDICATORS:

1. Select from the following list of terms those which are necessary life processes for all living things. Select three of these life functions and describe orally or in writing the mechanics of how they work. Tell what happens to carry out this process, how it works and the benefit to the living thing.
   Put an "X" by all the correct answers.

_____ Isolation	_____ Fermentation
_____ Reproduction	_____ Respiration
_____ Growth and Repair	_____ Ingestion
_____ Inspiration	_____ Responsiveness
_____ Nutrition	_____ Excretion

2. The following is a list of life processes which are essential to the survival of living things. For each of these processes explain what happens, how it happens, and why it is important to living things.

Reproduction	Responsiveness
Respiration	Excretion
Growth and Repair	Nutrition

3. Given the following examples of life situations, the student should identify the life functions or processes which would be taking place in a living organism under these conditions. Put the letter of the life processes in the blanks where they apply. If more than one apply, more than one blank will appear.

A. Digestion

B. Excretion

C. Respiration

D. Reproduction

E. Growth

F. Responsiveness

G. Ingestion - (eating food)

_____ 1. An animal breathing

_____ 2. The change of a baby to an adult

_____ 3. A deer runs from a hunter

_____ 4. An animal gets rid of wastes

_____ 5. and _____ 6. The process of nutrition in a living thing.

_____ 7. The production of seeds by a plant

_____ 8. and _____ 9. The breakdown of food and the using of that food for energy

_____10. The pointing of a plant towards the sun or any source of light

_____11. and _____12. A chicken lays an egg and 21 days later it hatches and a chick immerges

4. Describe how you tell the difference between living and non-living things. What processes do we associate with all living things that non-living things cannot do? Explain how these processes work, what they do and the benefit for the living things. List and explain at least 5 of these life processes.

LIFE SCIENCES

Cells

LS - 2

Pre-test: #1 and #2
Post-test: #3 and #4

The student will be able to list and explain the function of the significant structural features of the cell.

PERFORMANCE INDICATORS:

1. Match the structural feature or function with the part of the cell it is associated with.

   A. Cytoplasm
   B. Nucleus
   C. Cell membrane
   D. None of these
   E. All of these

   _____ 1. Controls what comes in and out of cell.
   _____ 2. Part of the cell where chromosomes are found.
   _____ 3. Part of the cell where proteins and other cell parts are made.
   _____ 4. The control center of the cell.
   _____ 5. Part of the cell where food particles are broken down into energy.
   _____ 6. Outer surrounding layer of cell which helps protect what's inside.

2. Fill the blanks in with the proper word or words.

   A. According to the modern ideas on structure in living things, all living things are made of building blocks. We call these building blocks _____.

   B. The control center where all cell activity is regulated is called the _____.

   C. The living part of the cell which carries out the life processes and

follows the orders of the nucleus is called the (this cellular material lies between the nucleus and the cell membrane) _____.

D. What surrounds the cell and controls what comes in and out of the cell _____.

3. A. Scientists describe the cell as the structural and functional unit of life. Explain why orally or in writing.

B. Explain orally or in writing the function or job that each of these cell structures are responsible for: cell membrane, nucleus, and cytoplasm.

4. Draw a typical cell and label the membrane, the nucleus and the cytoplasm. Explain the function or job that each of these perform for the cell.

LIFE SCIENCE

Levels of Organization

LS - 3

Pre-test: #1 and #2
Post-test: #3 and #4

The student will be able to list, compare and explain the different levels of organization found in living things by identifying the inter-relations of molecules, cells, tissues, organs and organ systems.

PERFORMANCE INDICATORS:

1. Match the statements, structures or kinds of living things to the level or organization in nature that they are associated with.

A. Atom

B. Molecule

C. Cell

D. Organ

E. Tissue

F. Organ System

_____ 1. A protozoan, Ameba, Paramecia, Euglena etc.

_____ 2. The liver

_____ 3. Brain, spinal cord and nerves

_____ 4. A jelly fish or a hydra which have just two body layers

_____ 5. Water or H_2O

_____ 6. A chromosome made of DNA

_____ 7. The digestive track from mouth to anus

_____ 8. Level of organization for all mammals

_____ 9. A group of cells working together to perform the same job

_____10. Bacteria

_____11. The smallest living thing (or part of a living thing) that can perform all the life functions

_____12. A group of tissues that work together to do a certain job

2. Given the following set of terms which represent levels of organization in nature, from non-living particles to the most complex living organisms. List these terms using numbers in order of complexity. Beginning with 1 being simplest, 2 being more complex, and so on with 6 being the highest level of organization we see in living things.

_____ Cells

_____ Molecules

_____ Tissues

_____ Atoms

_____ Organs

_____ Organ Systems

3. The following is a quote from Exploring Living Things, (Laid Law Brothers, Copyright 1977) about structures and parts of living things. Read it carefully and answer the questions which follow it.

> "One way of learning about different structures and parts is to divide a living thing, such as a person, into "levels of organization." The idea of levels of organization is not new. Think about your state. It has several levels of organization. A person is at the lowest, or simplest, level. People living close together form another level - towns or cities. Several towns or cities and some farmland usually make up a county. The counties, when taken together, make up a state."

The levels of organization we use for living things include these categories: cells, molecules, tissues, atoms, organs, and organ systems. Write a paragraph (or discuss it orally with your teacher) similar to one above to show how scientists use these levels of organization. Start with the simplest as above and work up to the most complex levels. Be sure to include what makes up each level and give examples of structures or parts which could be found grouped in each level.

4. List 4 levels of organization scientists use in classifying or categorizing living things. Also illustrate or explain how these levels of organization are related by using living things as examples.

LIFE SCIENCE

Organ Systems

Using man as an example, students will list the 10 organ systems we associate with higher organisms and explain the function or job each system must perform, giving examples of organs which work in each of these systems.

LS - 4

Pre-test: #1 and #4
Post-test: #2 and #3

PERFORMANCE INDICATORS:

1. Match the system on the right with the organ or statement with which it is associated from the left. Use letter answers in the blanks.

_____ 1. Bones, cartilage and ligaments	A. Epithelial or Integumentary (outside covering)
_____ 2. To protect body tissues from bacteria disease and drying out	B. Skeletal
_____ 3. Brain and spinal cord	C. Muscular
_____ 4. Arteries and veins	D. Nervous
_____ 5. Functions to move the body	E. Digestive
_____ 6. Sperm cells and egg cells	F. Circulatory
_____ 7. Chemical regulaters of the body	G. Respiratory
_____ 8. Trachea and lungs	H. Excretory
_____ 9. Give the body its form, structural support and protects important internal organs	I. Reproductive
	J. Endocrine (ductless gland)
_____10. Responsible for breaking down food substances	
_____11. The getting rid of wastes	
_____12. The kidneys	

_____ 13. Thyroid, pituitary, and pancreas

_____ 14. Breathing

_____ 15. The transportation of flow of materials throughout the body.

_____ 16. Controls all body activities both voluntary and involuntary

_____ 17. The testes and ovaries

_____ 18. Controls and responds to your senses

_____ 19. Hair and nails

_____ 20. Intestines

_____ 21. Produces hormones

2. List the 10 organ systems we associate with man and higher animals and give 2 examples of organs which function in each system. (oral or written)

3. List the 10 organ systems we associate with man and higher animals and explain the function of each of these systems must perform for the living thing. (oral or written)

4. The following is a list of the 10 organ systems we associate with man and other higher animals. For each of these systems list 2 organs which work in the system and the function or job which the system is responsible for.

A. Epithelial or Integumentary (outside covering
B. Skeletal
C. Muscular
D. Nervous
E. Digestive
F. Circulatory
G. Respiratory
H. Excretory
I. Reproductive
J. Endocrine (ductless glands)

LIFE SCIENCE

Food & Oxygen - Photosynthesis

The student will be able to explain the process of photosynthesis including the importance of this process in their everyday lives.

LS - 5

Pre-test: #1, #2, and #3
Post-test: #3 and #4

PERFORMANCE INDICATORS:

1. The process of photosynthesis in plants is a chemical reaction with things coming into the plant to be used and the plant making things from those incoming materials. From the following list of terms, put whether they are used in photosynthesis, are produced by a plant during photosynthesis or play no part in the process at all. Use an "I" by those which come in and/or are used, put a "P" by those which are produced and an "X" by those which do not belong or have no effect on photosynthesis.

_____ 1. Oxygen
_____ 2. Carbon dioxide
_____ 3. Ozone
_____ 4. Light
_____ 5. Soil
_____ 6. Water
_____ 7. Heat from the sun
_____ 8. Carbon monoxide
_____ 9. Chlorophyll
_____ 10. Sugar (stored energy)

2. The following is a list of statements about photosynthesis. For each statement put an "I" by all those that are incorrect and a "C" by all those which are correct.

_____ 1. Plants can make their own food by the process of photosynthesis.

_____ 2. Plants use the light from the sun for an energy source.

_____ 3. When plants undergo photosynthesis they take in water from their roots.

_____ 4. Plants take in oxygen through their roots to help them photosynthesize.

_____ 5. When a plant is photosynthesizing, its leaves give off carbon dioxide.

_____ 6. The process of photosynthesis is also important to animals because it provides them with oxygen and a source of chemical energy (food).

_____ 7. In photosynthesis plants take in oxygen from their leaves, sugar and minerals from their roots and mix it together with sunlight.

3. Fill in the chemicals, substances, molecules, etc. which belong in each of the blanks in the following equation of photosynthesis. Also explain the importance of this reaction in our everyday life either orally or in writing.

_____ + _____ In the presence of enzymes and _____ in a plant, with an energy source of _____ produces _____ + _____.

4. Explain in detail the process of photosynthesis including all substances, chemicals, energy sources, molecules, etc. which come in, must be there, are used, and are produced during this reaction. Also explain the importances of this reaction to the living world. (oral or written)

LIFE SCIENCE

Cycles

The student will be able to explain the water and carbon--oxygen cycles including their importance and relationships to man.

LS - 6

Pre-test: #1, #3, and #4
Post-test: #2 and #3

PERFORMANCE INDICATORS:

1. Match the statements using letter answers. Fill in all blanks. More than once blank means more than one answer. Answers <u>can</u> be used more than once.

   1. _____ _____ Ways water can enter air.

   2. _____ _____ _____ Ways carbon dioxide gets into the air.

   3. _____ A way oxygen gets into the air.

   4. _____ _____ Ways oxygen is removed from the air.

   5. _____ The process by which water vapor turns into rain.

   6. _____ The main way carbon dioxide is removed from the air.

   7. _____ A way carbon is made into a food like sugar

   8. _____ A way living things store their energy in a carbon compound.

   A. Carbohydrate

   B. Burning of hydrocarbons (wood and coal etc.)

   C. Animals breathing

   D. Plants photosynthesizing

   E. Rotting or decaying plants and animals

   F. Transpiration

   G. Evaporation

   H. Condensation

2. Explain in detail the carbon dioxide, oxygen and water cycles. Explain ways these chemicals enter the air, are removed from the air, what they are used for or good for and problems to man and the earth if these cycles are interupted. Include ways man alters or interupts these cycles and what we can do to prevent the problems which might follow from this interuption.

3. Prepare a complete detailed diagram of the carbon dioxide, oxygen and water cycles in nature. Also show points in the cycles where man tends to interupt, alter, or some how change these cycles and the possible problems which might follow from these changes.

4. The following is a list of statements about the carbon-oxygen cycle and the water cycle. Put a "C" by all the statements which are correct and an "I" by all those which are incorrect.

_____ 1. Carbon dioxide, oxygen and water can all be found in the air.

_____ 2. Carbon dioxide can be put in the air by the breathing of animal.

_____ 3. Oxygen can be put in the air by the burning of plants (wood, etc.)

_____ 4. Plants, animals, gasoline and coal all have carbon in them.

_____ 5. When plants and animals rot or decay, oxygen is usually returned to the air.

_____ 6. Plants use carbon dioxide from the air to help make food.

_____ 7. Animals get carbon by breathing in carbon dioxide.

_____ 8. Too much carbon dioxide in the air can be a form of pollution.

_____ 9. Plants give off water into the air.

_____10. Carbon compounds are commonly used by living things as a way of storing energy.

LIFE SCIENCE

Energy

The student will be able to explain the association between energy and food in an ecosystem or biome.

LS - 7

Pre-test: #1 and #2
Post-test: #3 and #4

Note: The student will be able to use examples of consumers, producers and decomposers in a food chain to illustrate the passage of energy from one living thing to another.

PERFORMANCE INDICATORS:

1. The following is a list of statements about energy. For each statement put an "I" by all those that are incorrect and a "C" by all those which are correct.

_____ 1. The original energy source for all living systems (ecosystems) is stored in the soil and picked up by plants with their roots.

_____ 2. The producers for the living world are plants because they capture and provide an energy source for all other living things.

_____ 3. Food for living things is a source of energy.

_____ 4. As food is passed up through a food chain from one consumer to another there is always a little more energy available at each step.

_____ 5. A food chain is a sequence of linked events used by scientists to describe the passage of energy from one living thing to the next.

_____ 6. Producers provide energy for the consumers.

_____ 7. Algae and mosses are examples of decomposers.

_____ 8. All consumers eat only animals as a source of food.

____ 9. All producers are capable of photosynthesis.

____10. In any living environment there will usually be a larger number of producers than decomposers and a larger number of consumers than producers.

____11. Energy travels in a cycle in the living world and can be used over and over again without any new energy being added.

____12. In a food chain there is more energy available to the mountain lion than the rabbits. We can tell this because the mountain lion is so much larger than a rabbit.

____13. Energy cannot be created or destroyed, but it can change forms.

Are the following correct examples of a food chain?
To be correct it must include examples of both consumers and producers.

____14. Bees make honey; the honey is eaten by a bear; the bear is eaten by man.

____15. Rats eat a man's garbage; a snake eats the rats; a coyote eats both the rats and the snake; man kills the coyote, and it gets decayed by bacteria and fungi.

____16. Grasshopper is eaten by a spider; the spider is eaten by a small bird; the small bird is eaten by a cat or hawk.

2. One important characteristic of all living things is that they have a need for energy to carry out all of their life processes. Answer these questions about how living things get and pass on energy. (oral or written)

   1. What or where does man get his energy from?

   2. What do we call a living thing which can make its own chemical energy? Give an example of a living thing which can do this.

3. Where do green plants get their energy from?

4. All living things have energy stored in them. Give examples to show how we know this. (At least two)

5. What happens to the energy in a living thing after it dies? Explain at least two possiblities.

6. All living things can have their energy either directly or indirectly traced back to one common source. What is this original and ultimate energy source for all living things?

7. Show by using examples of living things how energy is provided for and passed on in living systems (ecosystems). Trace the flow of energy through a living community. (forests, pond, etc.)

3. A. The flow of energy in an ecosystem is often illustrated by scientists with a tool called a food chain. Select an ecosystem (a piece of the living world—ocean, pond, forest, desert, etc.) and create a food chain in that ecosystem. Be sure to include and show examples of consumers, producers and decomposers in your food chain and have at least four different kinds of living things. (Tell which are consumers, producers, and decomposers.)

B. Answer these questions about your food chain, orally or in writing.

1. In your food chain, which kind of living thing has the greatest amount of energy available for its use?

2. Which kind of living thing has the least amount of energy available for its use?

3. Food chains must have an almost constant source of incoming energy. In your food chain, what is this constant source of energy?

4. What are some characteristics of both a food chain and energy flow that create this constant need for incoming energy? (Why must we have a constant source of energy for our ecosystem?)

4. Explain orally or in writing in detail how living things obtain and pass on energy. Be sure to include where the energy begins, stages it passes through and where it ends up. Include in your explanation the terms consumer, producer and decomposer.

LIFE SCIENCE

Resources

The student will demonstrate an understanding of man's relationship with the earth and its resources by being able to catagorize resources, substances, objects and materials important to man as being biodegradable, recycleable, renewable, nonrenewable, biotic or abiotic.

LS - 8

Pre-test: #1 and #2
Post-test: #3 and #4

Note: It is also important to consider origin of the resource, substance, object of material when applying these terms.

PERFORMANCE INDICATORS:

1. A. Place an "R" by the substances listed below which are made from renewable resources and an "N" by those which are from nonrenewable sources.

_____ copper wire
_____ body of an automobile
_____ furnace oil
_____ cotton pants
_____ paper bag
_____ styrofoam cup

B. Place a "B" by those substances which are biodegradable and an "N" by those which are not biodegradable.

_____ potatoe peelings
_____ aluminum cans
_____ paper
_____ glass bottles
_____ plastic bags
_____ styrofoam cup

C. Place an "X" by all those substances which can be recycled.

_____ candle
_____ styrofoam cup
_____ newspaper
_____ glass bottles
_____ gasoline
_____ aluminum cans

D. Next to each of the substances listed below, mark an "A" if it is abiotic and a "B" if it is biotic.

_____ cow manure	_____ water
_____ food	_____ wood
_____ oxygen	_____ sunlight

2. For the following list of substances put whether they are biodegradable, recycable or made from a renewable natural resource. Some may have none, one, two or three answers. If more than one answer applies, put all the correct answers. If none of these apply leave it blank. Explain your answers orally to your teacher.

B = biodegradable R = recycleable A = a renewable natural resource

_____ 1. aluminum can	_____ 7. body of an automobile
_____ 2. glass bottle	_____ 8. styrofoam cup
_____ 3. plastic bag	_____ 9. lumber
_____ 4. gasoline	_____ 10. cow manure
_____ 5. newspaper	_____ 11. coal
_____ 6. cotton pants	_____ 12. copper wire

3. The way we as a population use the resources of our earth determines the quantity, quality and usefulness of the materials we make from those resources. These terms—nonbiodegradable, biodegradable, recycleable, renewable, nonrenewable, describe origins of resources and what we do with these products when we are finished with them. Define these terms and list five examples of materials or substances we use in our everyday life which can be categorized as each.

4. Where things come from (their origin in nature) and what we do with them when we are through with them is very important when we consider our ability to maximize the efficient use of our natural resources. Every substance or material we use to help our everyday life seems to be limited in some way either by quantity, quality, disposability, price or convenience. But with limited resources and an increasing world population demanding more of those resources we must try to maximize the uses of these resources. The following is a list of terms which we use to describe either the origin of resources or what we do with already used resources:

biodegradable

nonbiodegradable

renewable

nonrenewable

recycleable

With these terms in mind, select 15 substances, materials or objects you use in your everyday life and tell what resources were used to produce these, which of these terms apply and what we do with them when we are finished using them.

LIFE SCIENCES

Cell Division

LS - 3

Pre-test: #1, #2 and #3
Post-test: #3 and #4

The student will explain the process of simple or growth type cell division including information about the cells produced, the nucleus, chromosomes and the importance of this kind of cell division.

PERFORMANCE INDICATORS:

1. When cells divide to produce 2 new cells identical to the original mother cell, we call this process "mitosis". The following is a list of statements about this process. Put a "C" by those which are correct and an "I" by those which are incorrect.

   _____ 1. When mitosis takes place in single celled plants and animals, we can call the process reproduction.

   _____ 2. When the mother cell divides, the nucleus divides also to produce 2 cells 1/2 the size and with 1/2 the amount of nuclear material.

   _____ 3. The reason the 2 new cells are the same as the mother cell after mitosis is because they have the same messages (chromosomes and genes) packed in the cytoplasm as the mother cell did.

   _____ 4. The process of mitosis is the way living things grow.

   _____ 5. Since the nucleus of all living cells is the same, the differences between different kinds of cells lies in their cytoplasm.

   _____ 6. Genes are little messages which control and determine what a cell is going to be or produce.

   _____ 7. Chromosomes are found in the cytoplasm of cells and aid them in their division.

   _____ 8. If the mother cell has 10 chromosomes, each of the 2 new cells produced by mitosis would have 5 chromosomes.

   _____ 9. The repair and replacement of damaged tissue is accomplished in living things by mitosis.

_____ 10. The repair and replacement of damaged tissues is accomplished in living things by mitosis.

_____ 11. Chromosomes in living things occur in pairs.

2. Living cells are capable of mitosis which is simple cell division. The following list of statements outline the steps which take place during this process. Rank in order these steps as they take place, with 1 being the first step, 2 being the second, and so on. Some of these statements do not apply to mitosis at all, put an X by those statements.

_____ A. The chromosomes pull apart and go to opposite sides of the cell.

_____ B. The genes come off of the chromosomes and line up along the cell membrane.

_____ C. Changes begin to take place in the nucleus. The nuclear membrane disappears and rod-like structures call chromosomes begin to appear.

_____ D. The chromosomes replicate (double) to produce twice as much chromosome material.

_____ E. The cell membrane disappears to allows all the contents of the cell except the nucleus to flow out of the way of the dividing cell.

_____ F. Chromosomes pair-up and line up and down the middle of the cell.

_____ G. The nucleus reorganizes, chromosomes change to chromatin material and the nuclear membrane reappears.

_____ H. A cell wall begins to appear around the nucleus.

_____ I. The cytoplasm begins to pull apart in animal cells and a wall begins to divide the cytoplasm in plant cells.

3. Explain the process of simple growth type cell division by using either diagrams, an itemized list or description of the important steps. Include information about the nucleus, chromosomes, number of cells produced by each division and a comparison of the parent and daughter cells (size, nucleus, chromosomes, etc.). Also indicate the importances of this kind of cell division.

4. Fill in the correct answers to the following questions or select the best answer and circle it.

   1. When simple cell division takes place in single celled plants and animals, we call the process _____.

   2. The main difference between a mouse and an elephant is found in:

      A) the kind of cells C) the number of cells

      B) the types of tissues D) the size of their cells

   3. If a cell has ten chromosomes, and this cell divides by simple cell division, how many chromosomes will the two new cells have produced?

   4. Small hereditary units which are found on chromosomes in the nucleus of cells are called _____.

   5. When simple cell division takes place in a cell, the result is:

      A) Two cells which contain the exact same information as the mother cell.
      B) Two cells twice the size of the mother cell.
      C) Two cells 1/2 the size and with 1/2 the number of chromosomes.
      D) Four cells each 1/4 the size of the mother cell.

   6. The main importance of simple cell division is that it allows complex living things to _____ and _____.

LIFE SCIENCE

Sexual Reproduction

The student will be able to explain the process of sexual reproduction we see in most living organisms including man.

IS - 10

Pre-test: #1, #2, and #3
Post-test: #2 and #4

PERFORMANCE INDICATORS:

1. Most living things reproduce by a process called sexual reproduction. The following are a list of statements which apply to sexual reproduction. If the statement is correct, put a "C" in the blank. If is is incorrect, put an "I".

_____ 1. One advantage of sexual reproduction is that it creates variation in a population of living things.

_____ 2. Chromosomes and genes occur in pairs in living things.

_____ 3. All living things have the same number of chromosomes, but they have different genes.

_____ 4. You can tell which person, mother or father, contributed most of the chromosomes by who the child looks like.

_____ 5. Fertilization is the process of producing eggs in sexual reproduction.

_____ 6. A sperm cell has twice as many chromosomes as a body cell of the animal which produced it.

_____ 7. Reduction cell division in sexual reproduction occurs immediately after egg and sperm cell come together.

_____ 8. All living things begin as a single cell called the fertilized egg.

_____ 9. Egg cells are larger than sperm cells because egg cells have twice as many chromosomes.

_____10. Sexual reproduction does not occur in plants because they have no ovaries or testes.

2. Explain orally or in writing the process of sexual reproduction we see in most living organisms. Important points or terms to be included and used in the description are testes, sperm cells, ovaries, egg cells, fertilization, chromosomes (from where and how many in all cells), and growth of fertilized egg.

3. Most living things including people reproduce by a process called sexual reproduction. The terms on the right are associated with this process. Match these terms with the statements about sexual reproduction. If there is more than one blank it means there is more than one answer. Fill all blanks with answers. Answers can be used more than once.

1. _____ The organ which produces the female contribution to sexual reproduction.
2. _____ The process which produces special cells called sex cells.
3. _____ A female sex cell.
4. _____ All members of a species have the same number of these red like structures in their cells.
5. _____ The study of the way traits are passed down from one generation to the next.
6. _____ The coming together of sex cells to begin the life of a new individual.
7. _____ The organ which produces the male contribution to sexual reproduction.
8. _____ The male sex cell.
9. _____ _____ These structures occur in pairs in living things and control the heredity of living things.

A. Reduction division
B. Fertilization
C. Ovaries
D. Testes
E. Sperm
F. Egg
G. Chromosomes
H. Genes
I. Mitosis
J. Heredity
K. Respiration

4. Matching: the following is a description of the events which take place in the reproduction and development of a typical placental mammal. Utilize the letters of the following terms to fill in the blanks with the proper organ, function, structure, etc.

A. mammary	F. fertilization	K. sperm
B. vagina	G. yolk	L. ovulation
C. umbilical cord	H. amnion	M. ovary
D. embryonic membrance	I. sweat	N. placenta
E. fetus	J. oviducts	O. testes
		P. uterus

In the female mammal the egg begins and matures in the ____. The egg then leaves this organ and starts a journey in the female down through tubes called the _____. In these tubes the male's contribution to the process, called _____, unites with the egg. The coming together of the egg and the substance from the male is called _____. The egg now is ready to begin development. In the female's body this development takes place in the _____. While in this development stage the embryo is nourished by a structure in the mother called the _____. The nourishment goes from this structure through a tube called the _____ to the embryo. At the end of a period of development in the mother the baby is born. After the baby is born it is still nourished by the mother with the help of special glands called _____ glands.

LIFE SCIENCE

Inheritance

LS - 11

Pre-test: #2 and #3
Post-test: #1 and #4

The student will be able to explain the interactions between heredity and environment in controlling the development of the individual and through a knowledge of genes explain how heredity controls what an individual can become.

PERFORMANCE INDICATORS:

1. Describe orally or in writing how heredity controls what an individual can become. Include the following information about genes—Where do we get them? What are they made of? What do they do? Where are they located? How many? How do we pass them on? etc. Also include a knowledge of the relationship between the individual, cells, nucleus, chromosomes, genes and DNA.

2. The following is a list of statements about inheritance. If the statement is correct put a "C" in the blank. If it is incorrect put an "I".

   _____ 1. A person gets exactly 1/2 of his genes from his mother and 1/2 from his father no matter who he looks like.

   _____ 2. When a gene changes within a sex cell, we call this a zygote.

   _____ 3. The only thing that controls what a person is going to become is his environment, not heredity.

   _____ 4. We know that the father controls the sex of the offspring and because of this, male children get more inherited characteristics from their fathers.

   _____ 5. An individual is made of cells each of which have a nucleus which contain chromosomes. These chromosomes have hereditary messages on them called genes which are nothing more than DNA molecules.

   _____ 6. Identical twins are always of the same sex.

_____ 7. A parent may pass on or give hereditary characteristics to his children which he, himself, does not show.

_____ 8. Some hereditary characteristics are influenced or controlled by the blood.

_____ 9. Children born to older parents usually lack the vitality of those born to younger parents.

_____10. The parent, with the stronger will, contributes more to a child's inheritance than the other parent.

_____11. Certain inherited traits may be altered by the stars, moon or planets early in development.

3. Circle the one right answer for each of the multiple choice questions below about inheritance.

1. Why are brothers and sisters different from one another?

A. Each inherits different acquired characteristics
B. Each gets his or her genes from a different parent
C. Differences in their environment cause them to be different
D. Each inherits a different combination of genes

2. What is inherited is determined by the nature of the:

A. environment
B. genes in the fertilized egg
C. cytoplasm in the fertilized egg
D. reduction divisions preceding fertilization

3. If the body cells of a living thing have 20 chromosomes, the egg cells produced by that living thing will have how many chromosomes?

A. 40
B. 20
C. 10
D. none, chromosomes come from sperm cells

4. When a gene changes in a sex cell, this change is called a:

   A. chromosome
   B. generation
   C. mutation
   D. zygote

5. A gene is:

   A. found on chromosomes
   B. located in the nucleus of cells
   C. made of DNA
   D. all of these

6. There are two forces which act together to produce differences among individuals. What you and every other living thing are today is controlled by these two factors. What are they?

   A. inheritance and heredity
   B. genes and chromosomes
   C. heredity and genetics
   D. heredity and environment

7. The characteristics which you inherited

   A. came from your mother and father in equal amounts
   B. were carried in the sperm cell from father and egg cell from mother
   C. are controlled by genes
   D. all of these are true

8. A certain plant bears white flowers. Its sex cells are acted upon by X-rays so that their DNA molecules are changed. The offspring of this plant bears red flowers. This change in flower color is :

   A. an acquired character

B. a dominant character
C. a recessive character
D. a mutation
E. none of these

9. If you removed a mouse's tail at birth, the loss of the tail would be:

A. a mutation
B. a hybrid
C. an acquired or nonhereditary characteristic
D. a recessive trait
E. fatal

10. Circle all of the true statements that follow about genes.

A. Genes always occur in pairs.
B. Genes are what controls your heredity.
C. Genes are acquired from your environment.
D. Genes can sometimes be hidden and not appear for generations.
E. Genes can never change.

4. Answer these questions orally or in writing and be as brief and specific as possible.

1. How many chromosomes do human beings have?

2. Where did you get your chromosomes from?

3. Chromosomes pack hereditary messages we call _____?

4. These hereditary messages interact with your _____

to produce the variety of characteristics we associate with you.

5. Can we tell <u>all</u> of the possible characteristics that you could pass on to your children by looking at the characteristics you show? Explain your answer (tell why or why not).

6. We know that an egg and a sperm cell are needed for the production of a new individual. Explain in detail how this egg and sperm are related to the hereditary characteristics of the new individual which will grow from this union.

LIFE SCIENCE

Predicting Heredity

The student will be able to predict some hereditary characteristics of the offspring from a given set of parental characteristics. Students must be able to make use of simple mendelian principles of inheritance including dominance, recessiveness and the law of segregation.

LS - 12

Pre-test: #1 and #2
Post-test: #3 and #4

PERFORMANCE INDICATORS:

1. A way of predicting the genes which can be found in the offspring is by using a box called the Punnett square. The following diagram illustrates how this works.

   In guinea pigs the gene for black (B) is dominant over the gene for white (b). If we crossed a black female (pure) with a white male using the Punnett square, it would look like this:

   Pure Black x white

   B B x b b

	b	b
B	Bb	Bb
B	Bb	Bb

F_1 generation

   Notice we put the genes one parent can give on one side and the genes the other parent produced on the other side. When we combine all the possibilities on the boxes we get all the possible combinations of offspring.

   If we cross two of the F_1 generation guinea pigs it would look like this:

   F_1 generation

   B b x B b

	B	b
B	BB	Bb
b	Bb	bb

F_2 generation

1) What are the colors of the F_1 generation Pigs?

2) What are all of the possible gene combinations we have in the F_2 generation and what color will all of these combinations produce?

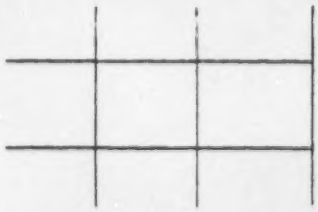
3) What fraction or percentage of the F_2 generation will be white?

4) What fraction or percentage of the F_2 generation will be black, but carry a hidden gene for white?

Complete the following examples and questions using a Punnett square to find all the possible offspring.

5) A black guinea pig with genes BB crossed with another black guinea pig with genes Bb.

BB x Bb



A. How often would these parents produce black offspring? (Fraction or percentage)

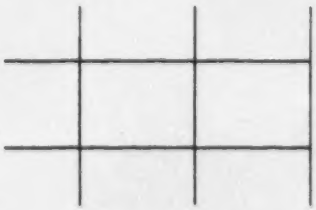
B. What portion or percentage of these black offspring would be capable of producing white offspring if crossed with a white guinea pig?

6) Fill in the blanks for genes of these guinea pigs and find the offspring in a Punnett square if we crossed—

A white female guinea pig with a black male guinea pig whose mother was white.

white guinea pig x black guinea pig

genes ___ ___ genes ___ ___

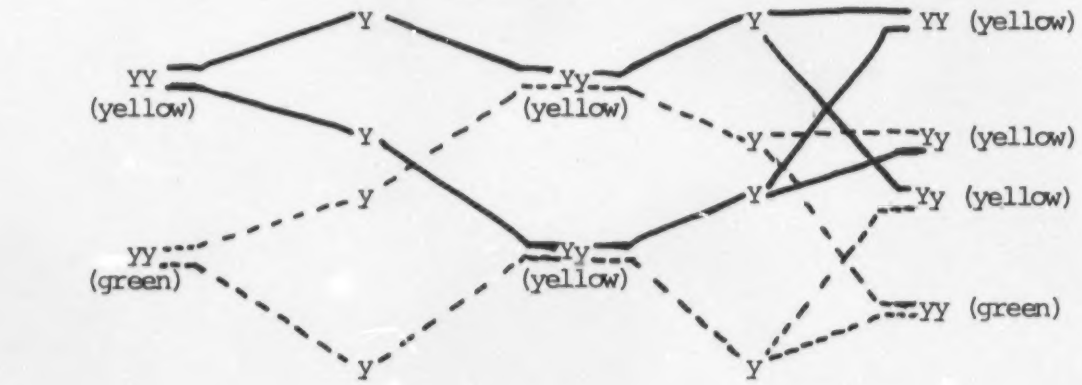


A. What fraction of percentage of the offspring from this cross will be white?

7) In guinea pigs, like in people, sex of the offspring is determined by the male. Please explain why and how this works. What portion or percentage of the offspring will be male? Use an example in the Punnett square to illustrate this answer.

2. The questions numbered 1-8 refer to the diagram. Study the diagram. Then read each question and select the correct answer to that question. Write the letter of the correct answer on the line beside the numeral.

Inheritance of Yellow and Green Seed Color in Garden Peas



Y = gene for yellow seed color

y = gene for green seed color

1. What can you say about the gene for yellow seed color?

   a. It is dominant
   b. It shows incomplete dominance
   c. It is recessive
   d. It shows mutation.

2. What can you say about the gene for green seed color?

   a. It is dominant
   b. It shows incomplete dominance
   c. It is recessive
   d. It shows mutation

3. What is the ratio of yellow to green seed in the F_2 generation?

   a. 4 to 1 b. 3 to 1 c. 2 to 1 d. 1 to 1

4. How many of the yellow seeds in the F_2 generation will have only the gene for yellow?

   a. 3 of 4 b. 3 of 3 c. 2 of 3 d. 1 of 3

We crossed a yellow seed producing plant with a green seed producing plant (Yellow x green). Some of the offspring produced yellow seeds and others produced green seeds. Based on this information and the information about yellow and green seed producing plants from above, answer these questions.

5. The genes of the yellow seed producing parent plant are:

   a. YY b. Yy c. yy d. We don't know for sure, you can't tell.

6. What are the genes of all the green seed producing plants?

   a. YY b. Yy c. yy d. They are not all the same, you can't tell.

7. The genes of the yellow seed producing offspring from this cross would be?

   a. Yy b. YY c. yy d. We don't know for sure, you can't tell.

8. What fraction or percentage of the offspring from this cross would

we expect to produce green seeds.

a. 1.4 or 25% b. 1/2 or 50% c. 1/3 or 33% d. There is no way to tell.

3. Blood type in people is controlled by 3 possible genes which when combined produces 4 different blood types. These combinations and the blood types they produce are listed below. (As you see, gene o is recessive to both genes A & B.)

Genes	Blood Type
AA & Ao	Type A
BB & Bo	Type B
AB	Type AB
oo	Type O

Answer these questions about blood type based on the information listed above.

1) A man with blood type AB married a woman with blood type AB. What are the possible blood types of their children?

2) In the following problems on blood types, determine the 2 genes for each of the 2 parents.

A. One parent is type A and the other type B, but all four types are represented in the children.

B. Both parents are type A, but three-fourths of the children belong to type A and one-fourth to type O.

C. One parent is AB and the other B, but of the children, one-fourth are A, one-fourth AB, and one-half B.

3) In the following cases of disputed paternity, determine the true father of the child based on the information given.

A. The mother belongs to type B, the child to O, one possible father is A and the other type AB.

B. The mother belongs to type B, the child to AB, one possible father is A and the other type B.

4. In man we will assume the gene for brown eyes B to be dominant over the gene for blue eyes b. Answer the following orally or in writing.

1) A brown-eyed man marries a blue-eyed woman and they have eighteen (18) children, all brown-eyed. What are the probable pairs of genes for all the individuals in the family?

Father (man) _____ _____ Mother (woman) _____ _____

Children _____ _____

2) A blue-eyed man named Jack had parents who were both brown-eyed. Jill and her father have brown eyes, but her mother has blue eyes. Jack and Jill got married and have a child who is blue-eyed. List the two genes each individual has for eye color in this family.

3) What is the probability or chance that Jack and Jill's next child will have brown eyes?

4) What is the probability or chance that Jack and Jill's next child will have blue eyes?

5) What is the chance that Jack and Jill's first child is a boy?

6) If the first child was a boy, what is the chance that the second child will be a boy?

ANSWERS

LS - 1

1. Reproduction
   Growth and Repair
   Nutrition
   Respiration
   Responsiveness
   Excretion

   Explain three of these. (Open—but must be 3 of these 6.)
   Refer to answers in #4.

2. Open to teacher discretion and interpretation, but should include two important points about each process. Best handled orally! Refer to answers in #4.

3. 1. C
   2. E
   3. F
   4. B
   5. & 6. G & A
   7. D
   8. & 9. A & C
   10. F
   11. & 12. D & E

   Answers for 5 & 6, 8 & 9, and 11 & 12 can be in either order.

4. Open to teacher discretion - with the following put forth as possible minimal suggested responses.

   Reproduction - This process provides new living things to take the place of old ones that die. Individuals die, but populations of living things still exist because of reproduction. Each kind of living thing produces other living things like itself.

   Growth and Repair - All living things are capable of growing and repairing minor damage. This growth depends on cells in two possible ways: If the cell or cells which make up a living thing get larger, the living thing grows on, and if the cells increase in number by cell division, the organism grows.

   Nutrition - This essential life process deals with the use of a food source as energy. All living things need energy to carry out life processes. The obtaining or producing of this food for energy is the process called nutrition.

ANSWERS

Respiration - This essential life process is responisble for the conversion of food materials into energy in a living organism. In other words the "burning of the fuel" in living things.

Responsiveness - The ability of living things to react or respond to their surroundings is the life process we call responsiveness.

Excretion - This life process deals with the elimination of waste products within a living thing which are built up from the normal functioning of cells. The collection and elimination of these wastes is excretion.

Movement - All living things are capable of using energy to cause the movement of living protoplasm. This can be movement within a cell, of the cell or of the organism as a whole.

LS - 2

1. 1. C
   2. B
   3. A
   4. B
   5. A
   6. C

2. A. cells
   B. nucleus
   C. cytoplasm
   D. cell (plasma) membrane

3. Open to teacher discretion with the following as minimal suggested responses.

   A. All living things are made of cells and cells carry out the life process of living things.

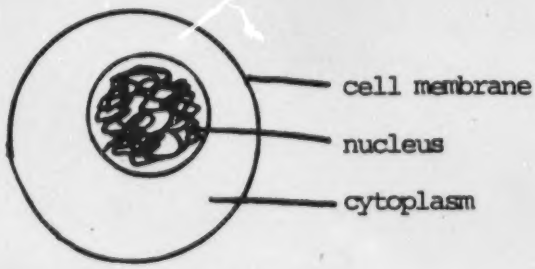
   B. Cell membrane - surrounds and protects the cell, controls what enters and leaves the cell.

ANSWERS

B. Nucleus - control center, contains chromosomes and genes, instructs the cell what to produce, etc.

Cytoplasm - carries out orders of the nucleus, where food is converted to energy, where proteins are made, lies between nucleus and cell membrane.

4. Functions are found in answer #3.



LS - 3

1.

1. C	7. F
2. D	8. F
3. F	9. E
4. E	10. C
5. B	11. C
6. B	12. D

2. 3 Cells

2 Molecules

4 Tissues

1 Atoms

5 Organs

6 Organ Systems

ANSWERS

3. Open - teacher's discretion
Refer to #2 for order, refer to #1 for possible examples or parts which could be grouped in each level.

4. Open - teacher's discretion

Cells - Tissues - Organs - Organ Systems
A group of specialized cells make up a tissue. A group of tissues which help to perform a specific function is an organ. A group of organs function together to carry out a specific job is an organ system.
For examples, look at item 1.

LS - 4

1.

1. B	8. G	15. F
2. A	9. B	16. D
3. D	10. E	17. I
4. F	11. H	18. D
5. C	12. H	19. A
6. I	13. J	20. E
7. J	14. G	21. J

2. Open to teacher's discretion - Organ systems listed in items 1 and 4. Some obvious examples are in item 1, many others are acceptable.

3. Open to teacher's discretion - Systems listed in items 1 and 4. Some possible examples are in item 1; the functions are found in answers to item 4.

4. Epithelial or Integumentary - To protect body tissues from bacteria, disease and drying out. Outside covering.

Skeletal - Gives the body its form, structural support and protects important internal organs.

Muscular - Functions to move the body.

Nervous - Controlls all body activities both voluntary and involuntary. Controls and responds to your senses.

ANSWERS

Digestive - Responsible for breaking down food substances.

Circulatory - The transportation or flow of materials throughout the body.

Respiratory - Responsible for the conversion of food to useable energy in living things. Breathing is how we get O_2 to accomplish this.

Excretory - The getting rid of cellular or metabolic wastes.

Endocrine - Chemical regulator of the body. Produces hormones, ductless glands.

LS - 5

1. 1. P
   2. I
   3. X
   4. I
   5. X
   6. I or I & P (not just P)
   7. X
   8. X
   9. I
   10. P

2. 1. C
   2. C
   3. C
   4. I
   5. I
   6. C
   7. I

3. H_2O or water + CO_2 or carbon dioxide (These can be in either order.)

   chlorophyll

   light

   O_2 or oxygen + $C_6H_{12}O_6$ or Glucose or sugar (These can be in either order.)

4. Refer to items 1, 2, and 3.

ANSWER

LS - 6

1. 1. G & F
   2. B, C, & E
   3. D
   4. B, E, & C (2 of these 3)
   5. H
   6. D
   7. D
   8. A

2. Carbon-Oxygen Cycles

The carbon dioxide which is found in air was put there 3 main ways: 1) burning fossil fuels, 2) animal respiration (breathing), and 3) the decaying or rotting of organic material like dead plants, animals and other biotic wastes. These same 3 processes do just the opposite in the oxygen cycle, all 3 remove oxygen from the air. Oxygen is returned to the air almost exclusively by the process of plant photosynthesis. This process also removes carbon dioxide from the air and converts these molecules of carbon into organic compounds called carbohydrates (sugar, starches, oils and other food products). This means there is carbon in all biotic materials (things which are or were alive). When these biotic materials are eaten, burned or rotted and decayed the carbon is returned to the air mostly in the form of carbon dioxide. The other source of carbon on earth is in the form of fossil fuels which were one alive and now have their carbon stored as hydrocarbons.

Possible Problems

Too much carbon dioxide can get into the air by excess fossil fuel burning and lack of photosynthesis. If we get too much CO_2 in the air we can cause what is called the "green house effect". A decrease in percentage of oxygen in air would make it impossible for animals to breath. This can be caused by man removing most of the vegatation in the world.

Water Cycle

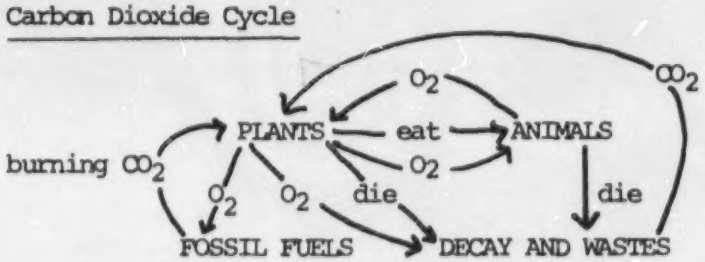
Water enters the air by evaporation or by transpiration (water which enters the air from plants). Condensation converts this gaseous water into a liquid and it

falls to earth as rain. This rain can run off the land as a river or stream, or can sink underground into the water table. Most of the water however is stored in the oceans.

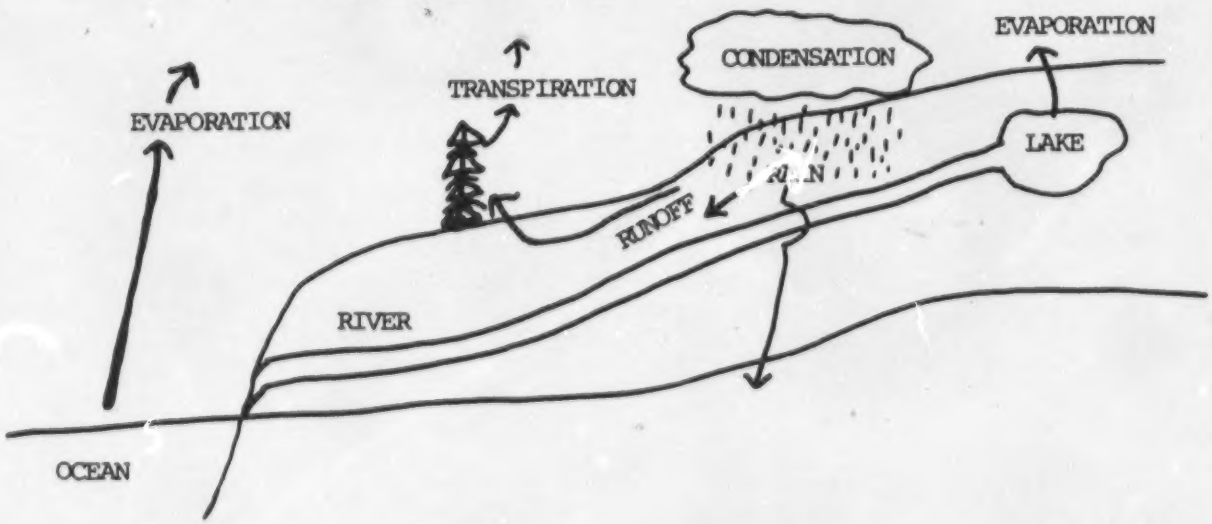
Potential Problems

Cloud seeding to change where nature would normally put rain. Removing too much water from the underground water table. This water can support land, and if it gets too low, sea water will enter and kill plants, etc.

3. Carbon Dioxide Cycle



Water Cycle



ANSWERS

4. 1. C
2. C
3. I
4. C
5. I
6. C
7. I
8. C
9. C
10. C

LS - 7

1. 1. I
2. C
3. C
4. I
5. C
6. C
7. I
8. I
9. C
10. I
11. I
12. I
13. C
14. I
15. I
16. I

(All 3 of these incorrect because they have no producer)

2. 1. From his food—the food if it is an animal got the energy from plants the plants got the energy from the sun by way of photosynthesis.

2. Producer, all green plants

3. The sun or any light source

4. If we burn them, we get heat and light out which are both energy. If we eat them, we get energy for living out. Living things move and that takes energy and living things grow which also takes energy.

5. It can be stored—fossil fuels (coal and oil etc) animals can eat it and use it. It can decay and provide energy for decay organisms like bacteria and fungi.

6. Sun

7. Green plants change light into stored chemical energy—consumers eat these and it changes form again—another consumer eats this consumer and each time some is used up, some is wasted as heat. Then when things die, lose parts, get rid of waste etc., the energy is used by decay organisms.

3. Answer will vary depending on which ecosystem students choose. Generally it follows this pattern:

ANSWERS

A. sun - producers - 1st or primary consumer - secondary consumer - wastes, lost parts, dead organisms etc. - decomposers

B. Answer will vary depending on student's answer to part A.
   1. the producer
   2. secondary or final consumer
   3. light
   4. At each step some is used and some is lost as heat, so, there is less and less available at each step and energy does not cycle, it travels in one direction

4. Open to teacher's discretion; answers should be like those in items 1, 2, and 3.

LS - 8

1. A.
N - copper wire
N - furnace oil
R - paper bag
N - body of an automobile
R - cotton pants
N - styrofoam cup

B.
B - potatoe peelings
B - paper
N - plastic bag
N - aluminum cans
N - glass bottles
N - styrofoam cup

C.
X - newspaper
X - glass bottles
X - aluminum cans

D.
B - cow manure
B - food
A - oxygen
A - water
B - wood
A - sunlight

2.
1. R
2. R
3.
4.
5. B R A
6. B A (R is optional)
7. R
8.
9. B A (R is optional)
10. B A
11.
12. R

ANSWERS

3. Biodegradable - Any substance or material which can be broken down in nature by decay or rotting. This process is usually caused by bacteria and fungi.
Examples: wood, paper, feces, manure, cotton, wool, dead plants and animals.

Nonbiodegradable - Will not break down through the action of living organisms in nature.
Examples: metals, synthetics, plastics, styrofoam, etc.

Recycable - Anything which can be reused to produce something of use to society; any substance which can change forms.
Examples: metals (copper, iron, aluminum, etc), paper, glass

Renewable Natural Resource - This is a resource of the earth which can be produced or grow if conditions are right.
Examples: wood, and all products of wood, cotton, seaweed

Nonrenewable resource - This is a resource which we have a limited supply of and we can never produce anymore.
Examples: fossil fuels (coals, oil, etc), metals (aluminum, copper, uranium, etc)

4. Open to teacher discretion. Refer to items 1, 2, and 3 for possible answers.

LS - 9

1.

1. C	6. C	11. C
2. I	7. I	
3. I	8. I	
4. C	9. C	
5. I	10. C	

2.

A. 4	F. 3
B. X	G. 6
C. 1 or 2	H. X
D. 1 or 2	I. 5
E. X	

ANSWERS

3. Open to teacher's discretion. Refer to #1, #2 and #4.

4. 1. Reproduction
   2. C - the number of cells
   3. 10
   4. Genes
   5. A
   6. Growth and Repair

LS - 10

1. 1. C
   2. C
   3. I
   4. I
   5. I
   6. I
   7. I
   8. C
   9. I
   10. I

2. Open to teacher's discretion. Refer to #1, #3 and #4.

3. 1. C
   2. A
   3. F
   4. G
   5. J
   6. B
   7. D
   8. E
   9. G & H

4. 1. M
   2. J
   3. K
   4. F
   5. P
   6. N
   7. C
   8. A

LS - 11

1. Open to teacher's discretion. Refer to #2, #3, and #4.

2. 1. C
   2. I
   3. I
   4. I
   5. C
   6. C
   7. C
   8. I
   9. I
   10. I

ANSWERS

3.

1.	D	6.	D
2.	B	7.	D
3.	C	8.	D
4.	C	9.	C
5.	D	10.	A, B & D

4. 1. 23 pairs or 46
2. 1/2 from mother and 1/2 from father
3. genes
4. environment
5. No. Because you have many genes which are mask or hidden that can reappear in your offspring.
6. The egg carries a specific combination of genes from the mother. The sperm carries one of the millions of gene combinations possible from the father. When these unite, the combinations of genes from egg and sperm cell create the exact gene combination and heredity of the individual which grows from this fertilized egg.

LS - 12

1. 1. black
2. BB is black, Bb is black and bb is white
3. 1/4 or 25%
4. 1/2 or 50%
5.

	B	b
B	BB	Bb
B	BB	Bb

A. all or 100%

B. 1/2 or 50%

6. genes b b genes B b

	b	b
B	Bb	Bb
b	bb	bb

A. 1/2 or 50%

ANSWERS

7. The male has an X and A Y chromosome. The female has only 2 X chromosomes. When reduction division takes place the male can produce two kinds of sperm; those which carry an X chromosome and those which carry a Y chromosome. The female will produce eggs which always have an X chromosome. During fertilization if an X carrying sperm fertilizes the egg it will be a female. If a Y sperm it will be a male.

Male	Female
XY	XX

		female	
		X	X
male	X	XX	XX
	Y	XY	XY

1/2 or 50% of the time the offspring will be male.

2. 1. A
   2. C
   3. B
   4. D
   5. B
   6. C
   7. A
   8. B

3. 1. Type A, Type B and Type AB

   2. A. Type A parent genes = A o, Type B parent = B o

      B. Type A parents are both A O

      C. Type AB parent has genes A B. The type B parent has genes B O

   3. A. The type A man is the father.

      B. The type A man is the father.

ANSWERS

4. 1. Father B B Mother b b children B b

2. Jack b b Jack's parents B b Jill B b

Jill's father B _ (we don't know this one)

Jill's mother b b

3. 1/2 chance brown eyes.

4. 1/2 chance blue eyes.

5. 1/2 chance boy.

6. 1/2 chance boy.